5 Inventory

The inventory information gathered for this subbasin was derived from interviews, self-reporting by project managers, and by searching existing databases. The Yakama Indian Nation, Skamania County, Klickitat County, WDFW and the Department of Ecology provided information used in this plan.

5.1 Fisheries

WDFW has documented bull trout in creel surveys during the 1980's; however in 2001, along with the Yakama Nation, have done extensive snorkeling and electrofishing surveys in the White Salmon River that have not found bull trout. Located just 3.3 miles from the mouth of the White Salmon River, Condit dam, which was constructed in 1916 and is scheduled to be removed by 2006, dominates fishery concerns in the subbasin. Removal of the dam will radically alter the potential to re-introduce anadromous fish into the subbasin. Much of the work above the dam that benefits fisheries has been a result of the effects of other programs such as the Northwest Forest Plan or the state of Washington's "forest and fish" rules.

The White Salmon watershed enhancement project is a comprehensive effort aimed at improving fish habitat, riparian and upslope watershed conditions, and land stewardship through direct restorative actions, cooperative work with stakeholders, and promoting education and citizen involvement. This project involves many federal, state, county and private parties and sets the stage for stong improvements in habitat quality throughout the subbasin.

Rattlesnake Creek, a major tributary to the White Salmon, has been extensively studied to assess its' before dam removal habitat condition, and has been proposed for ongoing study after dam removal to gauge the effects and speed of anadromous fish re-introduction efforts.

5.2 Wildlife

WDFW has, since the 1950s, surveyed mule deer populations, gathered hunting statistics and has worked with landowners on deer habitat projects that have benefited many species that use shrub steppe habitat. WDFW has also conducted periodic surveys and studies of Western gray squirrel populations and habitat. Working with zoos and federal agencies WDFW has been attempting to increase the pond turtle populations in the subbasin.

WDNR has surveyed spotted frog egg masses since 1996.

Note: Watershed planning under the Washington Watershed Planning Act for water quanitity purposes has commenced in the Wind and White Salmon watersheds and is expected to produce a final report before summer 2005.

Table 30 Projects within the White Salmon Subbasin

Project # and/or Name/	Responsible Party	Target Species	Project Description	Project Duration	Project Location or Geographic Scale Affected	GAP Analysis Statement
Mule deer	WDFW	Mule deer	Ongoing effort to survey and manage deer populaton via hunting program. Surveys and harvest statistics provide annual data used to set hunting seasons and address population trends.	1950s-ongoing	All White Salmon subbasin habitats with emphasis on winter range	
Western pond turtle, Columbia River Gorge	WDFW	Western pond turtle	Ongoing effort in cooperation with USFWS, Oregon Zoo, Woodland Park Zoo, and the USFS to increase native populations and eventually remove the turtle from the state endangered species list.	1985-ongoing	White Salmon subbasin wetland	
Oregon Spotted Frog Surveys	WDNR	Oregon spotted frog	Annual egg mass survey counts in the spring	1996-ongoing	White Salmon Subbasin riparian-wetland habitats	
Western gray squirrel research and management	WDFW	Western gray squirrel	Ongoing effort to survey and manage WGS population and associated habitat. Periodic surveys are done to document occurrences in White Salmon drainage with emphasis in Rattlesnake Cr. Watershed. WDFW monitors timber harvest through forest practice regulations and land divisions through county planning dept.	1990-ongoing	White Salmon Subbasin pine/oak habitat	

Project # and/or Name/	Responsible Party	Target Species	Project Description	Project Duration	Project Location or Geographic Scale Affected	GAP Analysis Statement
Bull Trout Population Assessment in the White Salmon and Klickitat rivers, Columbia River Gorge, Washington Project # 1999-024-00	WDFW, Yakama Nation	Bull trout	Snorkeling and electroshocking were used to determine the presence or absence of bull trout in the White Salmon and Klickitat River basin during summer and fall 2001. No bull trout were found in the White Salmon River basin. In the Klickitat River basin, bull trout were found only in the West Fork Klickitat River drainage.	2001		
Rattlesnake Creek Riparian Restoration Project	Underwood Conservation District (UCD) and DNR		Demonstrating modern approaches to riparian zone and in-channel restoration.	1989	Rattlesnake Creek	

Project # and/or Name/	Responsible Party	Target Species	Project Description	Project Duration	Project Location or Geographic Scale Affected	GAP Analysis Statement
White Salmon watershed enhancement project	UCD, USFS, DNR, timber companies, and other cooperators	Spring and fall chinook salmon, coho salmon, coastal cutthroat, winter and summer steelhead, resident rainbow and cutthroat trout, bull trout.	A comprehensive effort aimed at improving fish habitat, riparian and upslope watershed conditions, and land stewardship through direct restorative actions, cooperative work with stakeholders, and promoting education and citizen involvement. Past accomplishments: 1993: Formation of watershed council (WMC) in White Salmon River watershed 1994: Watershed Assessment Project (Ecology funded) done, Watershed Enhancement Plan, Water Quality Investigation Report, Watershed Land-Use Evaluation Report. 1996: Trout Lake Creek Watershed Analysis (USFS) completion 1997: Cave/Bear Watershed Analysis (USFS), Panakanic (Upper RSC) Watershed Analysis (DNR), Watershed Enhancement Project - Phase I (Ecology funded) 1998: Upper White Salmon River Watershed Assessment (USFS), White Salmon River Watershed Enhancement Project - Phase II	1992 to ongoing	White Salmon	

Project # and/or Name/	Responsible Party	Target Species	Project Description	Project Duration	Project Location or Geographic Scale Affected	GAP Analysis Statement
Washington's "Forest & Fish" agreement	Washington Forest Practices Board		The rules are intended to develop biologically sound, economically practical and responsible forest management practices to improve streamside habitat on Washington's non-federal forestlands. Specifically, they: Better protect water quality and fish habitat by widening streamside buffers on most private and state forestlands; Revise engineering requirements for locating and designing new roads, bridges and culverts; and for maintaining and abandoning existing roads; Increase environmental review for logging, road building and other forest practices affecting unstable slopes; and Keep the rules scientifically sound by incorporating new and updated scientific findings into the rules, as that information becomes available, through an adaptive management process. Regulated forest practices affect timber harvest, road building, reforestation, brush control, and pesticide and fertilizer use on 12 million acres of private and state-managed land	Ongoing from July 1, 2001.	Non-federal forestlands in Washington Satte.	
Wind-White Salmon Watershed Planning (WRIA 29)	Skamania County		The Watershed Management Act to provides a framework for local citizens, interest groups, and government organizations to collaboratively identify and solve water quantity related issues in the watershed.	Plan due date is 2nd quarter of 2005	Wind River, White Salmon River	

Project # and/or Name/	Responsible Party	Target Species	Project Description	Project Duration	Project Location or Geographic Scale Affected	GAP Analysis Statement
Assess current and potential salmonid production in Rattlesnake Creek associated with restoration efforts	U.S. Geological Survey, Underwood Conservation District, Yakama Nation	rainbow trout (steelhead), cutthroat trout resident and anadromous), coho and chinook salmon	Address a unique opportunity to document habitat conditions and fish population status within the Rattlesnake Creek watershed prior to major habitat restoration activities and before Condit Dam removal and the reintroduction of anadromous salmonids.	2004 through 2006, ongoing	Rattlesnake Creek	
Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (NW Forest Plan)	BLM, USFS	Multi-species, spotted owl	Takes an ecosystem management approach to forest management, with support from scientific evidence; meet the requirements of existing laws and regulations; maintain a healthy forest ecosystem with habitat that will support populations of native species (particularly those associated with late-successional and old-growth forests), including protection for riparian areas and waters; and maintain a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies on a predictable and long-term basis.	Ongoing	Federal lands in the Northwest U.S.	
Condit Dam Settlement Agreement	FERC, PacificCorp		PacifiCorp and interveners in the FERC relicensing proceedings signed a settlement agreement. The agreement, yet to be approved by FERC, stipulates the removal of Condit Dam by year 2006.	1999	White Salmon River	
Anadromous fish Spawning surveys	PSMFC	Spring chinook, fall chinook and chum salmon	Annual surveys of redds	1964	Lower White Salmon River	

6 Management Plan

Introduction

The management plan integrates the vision for the White Salmon subbasin with the assessment and inventory. That vision for the subbasin extends over 10 to 15 years and represents local policy input to the subbasin plan. The selection of biological objectives and strategies for restoration of fish and wildlife habitat and populations which form the bulk of the management plan is derived from that input.

The scope of the management plan is somewhat narrower than the scope of the assessment or the inventory. The assessment and inventory are designed and may be used to guide restoration and management actions by many parties under their own authorities in the course of ongoing efforts to protect and enhance the fish and wildlife populations and the aquatic and terrestrial ecosystems that exist within the White Salmon subbasin. The management plan is based on the assessment and inventory, but is specifically designed to act as a draft Amendment to the Columbia Basin Fish and Wildlife Program, and to be reviewed and approved by the Northwest Power and Conservation Council (NPCC).

The management plan outlines biological objectives and strategies that the planners feel would most efficiently address primary limits to fish and wildlife production in the subbasin. That road map allows the NPCC and BPA to more effectively meet their obligations in the subbasin to mitigate and protect resources affected by the construction and operation of the Federal Columbia River Power System. As such, it is non-regulatory in nature, and is based on the use of BPA ratepayer funds to construct or improve existing infrastructure, to acquire land or protective easements as a means of habitat protection, to fund personnel to improve management of natural resources, to monitor and research the relationships between management actions and the health of the resource, and to fund other actions that protect or restore the health of natural resources that have been negatively impacted by the FCRPS.

This management plan was developed in a relatively short time frame, as the Klickitat, White Salmon and Lower Middle Mainstem were among the last subbasins to get started in the NPCC Subbasin Planning Process.

The White Salmon subbasin management plan strategies are based on an assessment of the needs of three focal wild habitat types,eight focal wildlife species and five focal fish species. Focal habitats are montane coniferous wetlands, ponderosa pine/Oregon white oak forests and interior interior riparian wetlands. Focal wildlife species include western gray squirrel, Lewis' woodpecker, Oregon spotted frog, American beaver, yellow warbler and western pond turtle. Wildlife strategies were devised based on the condition, availability and potential for restoration of a variety of focal habitat types. Those habitats are interior riparian-wetlands, interior grasslands, shrub steppe and ponderosa pine / Oregon white oak.

Focal fish species include fall and spring chinook salmon, coho salmon, steelhead and resident rainbow trout.

The traceable logic displayed below in table form focuses on strategies that benefit focal wildlife species that inhabit the subbasin's terrain and focal fish species that utilize the White Salmon River and its tributaries.

6.1.1 Vision

We envision healthy self-sustaining populations of fish and wildlife indigenous to the Columbia Basin that support harvest and other purposes. Decisions and recommendations will be made in a community based, open and cooperative process that respects different points of view, and will adhere to all rights and statutory responsibilities. These efforts will contribute to a robust and sustainable economy.

6.1.2 Guidelines

The *Technical Guide for Subbasin Planners* recommends that the Management Plan contain the following elements Biological Objectives and Strategies.

Biological Objectives should:

- Be consistent with basin-level visions, objectives, and strategies adopted in the program.
- Be based on the subbasin assessment and resulting working hypothesis.
- Be consistent with legal rights and obligations of fish and wildlife agencies and tribes with jurisdiction over fish and wildlife in the subbasin, and agreed upon by co-managers in the subbasin. Where there are disagreements among co-managers that translate into differing biological objectives, the differences and the alternative biological objectives should be fully presented.
- Be complementary to programs of tribal, state and federal land or water quality management agencies in the subbasin.
- Be consistent with the Endangered Species Act recovery goals and Clean Water Act requirements as fully as possible.
- Be quantitative and have measurable outcomes.

Strategies must:

- Explain the linkage of the strategies to the subbasin biological objectives, vision and the subbasin assessment Explain how and why the strategies presented were selected over other alternative strategies (e.g. passive restoration strategies v. intervention strategies)
- Describe a proposed sequence and prioritization of strategies
- If necessary, describe additional steps required to compile more complete or detailed assessment.

6.1.3 Biological Objectives

Due to the late start in subbasin planning, the biological objectives based on EDT only became available late in the process and the YN and Klickitat County have not had time for review. Without this review, these should be interpreted as a WDFW position.

The White Salmon management plan biological objectives and strategies focus on two scenarios -- one with the subbasin segmented by Condit Dam and by water falls further upstream at river mile 16 and the other with access restored for salmon and steelhead that spawned in the river and tributaries above the dam before access was blocked.

Condit Dam was built in 1913 at river mile 3.4. A settlement agreement is now pending before the Federal Energy Regulatory Commission to have the hydroproject removed as soon as 2006

Biological objectives for the White Salmon River basin are intended to be consistent with legal rights and obligation of fisheries and wildlife agencies and tribes, complementary to land and water quality management programs, and consistent with ESA and CWA, and quantitative. Currently, salmon and steelhead populations in the White Salmon River are either listed for protection under the ESA or are a candidate for listing under ESA. The vision for the subbasin includes rebuilding anadromous populations of salmon and steelhead to healthy and harvestable levels. This statement implies that these populations will no longer need protection under the ESA.

Steelhead populations in the White Salmon River fall in the Middle Columbia River ESU and all other populations fall into the Lower Columbia River ESU. The Willamette-Lower Columbia Technical Recovery Team identified the White Salmon River as a demographically independent population for spring chinook salmon and tule fall chinook salmon. Chum salmon in the White Salmon basin were not considered to be demographically independent and chum salmon spawning in the White Salmon River were considered part of the Upper Gorge Population of the Columbia River.

The Willamette and Lower Columbia Technical Recovery Team, which was formed by NMFS, has established ESU recovery goals for chum and chinook salmon and population specific viability goals. The population criteria for productivity and abundance, within population spatial structure, within population diversity, juvenile outmigrants (JOM) growth rate, and habitat are listed below (WLC-TRT 2003). Although not all individual populations in the Lower Columbia River ESU are needed to be viable for the ESU to be delisted, these criteria provide metrics for a healthy population. Since the subbasin goal is healthy and harvestable salmon and steelhead populations, the criteria guidelines provide a basis for numerical biological objectives.

The WLC-TRT found it difficult to quantify diversity, spatial structure, and habitat goals. However, it was able to quantify abundance and productivity, and JOM goals. The JOM goal is simply that the number of juveniles salmonids moving to the ocean should not decline. The adult productivity and abundance goals were developed using the Population Change Criteria (PCC) methodology due to the availability of data and the limited assumption required in the model. However, when hatchery spawners are present the model tended to yield unrealistic results. Therefore, the abundance was capped at a credible estimate of historical abundance.

Since spring chinook have been extirpated and fall chinook abundance is likely to be reduced in the short-term due to sedimentation from dam removal, the default PCC criteria would likely apply in this basin. Using this approach the population of both spring and fall chinook salmon would have to reach 1,400 adults within a 20-year period. For chum salmon, the abundance target is for the upper Gorge population, which includes fish spawning in the White Salmon River, is 1,100 adults. Although no recovery goals have been established by Interior Columbia River Technical Recovery Team for Middle Columbia River steelhead, applying the PCC methodology to steelhead in the White Salmon would produce a goal of 600 summer and 600 winter steelhead.

The WDFW has proposed biological objectives for salmon performance are based on a rehabilitated White Salmon subbasin. These goals explicitly recognize the White Salmon subbasin will not be returned to pristine condition and human impacts are and will continue, but expect that salmon performance would reach the “healthy and harvestable levels” desired in Washington’s Statewide Salmon Strategy (JNRC, 1999). This approach has been used by WDFW for subbasin goals in the Columbia River below the White Salmon River and in Puget Sound.

The underlying assumptions in setting biological objectives using the EDT model is that the model, on average, adequately predicts salmon performance based on environmental attributes, that the estimates of environmental attributes used for modeling are accurate, and that biological data (age structure, sex ratio, fecundity, and migration patterns) are accurate. To describe environmental attributes that do not risk salmon performance WDFW used habitat conditions described by NMFS “properly functioning conditions” (PFC) matrix (NMFS 1996). Using the EDT modeling approach, each environmental attribute was improved to PFC if needed and the model was re-run using PFC conditions for all reaches as the desired future condition for the subbasin to develop salmon and steelhead performance goals.

Table 31 and figure 53 describe salmon and performance under current, dam removal after sedimentation has stabilized, dam removal with PFC, and historical condition. An abnormality exists for fall chinook performance, where the current habitat restored to PFC is higher than historic potential. In this case fall chinook rearing area is increased due to the BON pool inundating the lowest reaches of the White Salmon River. This creates additional juvenile rearing habitat and decreases bed scour.

For all other species there is an increasing cline of performance as one moves from current to historic potential. Salmon performance under dam removal would be viewed as short-term biological objective and under dam removal at PFC as long-term biological objectives. PFC represents a midway point between current conditions with dam removal and historical conditions. In addition to meeting ESA, achieving these biological objectives would allow for meaningful fishing opportunities in tribal, commercial, and recreational fisheries and non-consumptive benefits.

One EDT output is a Beverton-Holt spawner-recruit curve. The WLC-TRT examined using a spawner-recruit model approach for setting recovery goals but it was not used to develop population specific goals in the White Salmon River because currently the data required for this approach are lacking. The EDT parameters of productivity, abundance, and life history diversity correspond directly to the same NOAA Fisheries viability parameters. However, the comprehensive population monitoring program proposed in this document would provide sufficient data to develop and evaluate such an approach. The abundance and productivity from the EDT model have not been evaluated by the WLC-TRT.

However, it is WDFW's opinion that the proposed salmon and steelhead productivity and abundance under the PFC, if realized, would likely meet recovery goals. The short-term biological objective is salmon performance under dam removal and the long-term biological objective is salmon performance under dam removal and PFC.

Table 31 WDFW proposed future scenarios for the White Salmon River.

Population	Scenario	Diversity index	Productivity	Capacity	Abundance
Coho Salmon	Current without Harvest	6%	3.7	643	470
	Dam Removal	15%	2.0	1898	952
	Dam Removal with PFC	57%	3.0	1828	1227
	Historic potential	70%	4.1	1694	1278
Fall Chinook Salmon	Current without Harvest	89%	6.2	1170	982
	Dam Removal	79%	3.7	1086	792
	Dam Removal with PFC	94%	5.6	1210	995
	Historic potential	98%	7.1	868	745
Steelhead	Current without Harvest	4%	4.1	26	20
	Dam Removal	78%	3.3	429	301
	Dam Removal with PFC	95%	7.1	633	544
	Historic potential	95%	20.4	1196	1137
Spring Chinook Salmon	Current without Harvest	0%	0.0	0	0
	Dam Removal	71%	3.1	835	570
	Dam Removal with PFC	99%	5.1	1013	814
	Historic potential	100%	7.2	1012	871

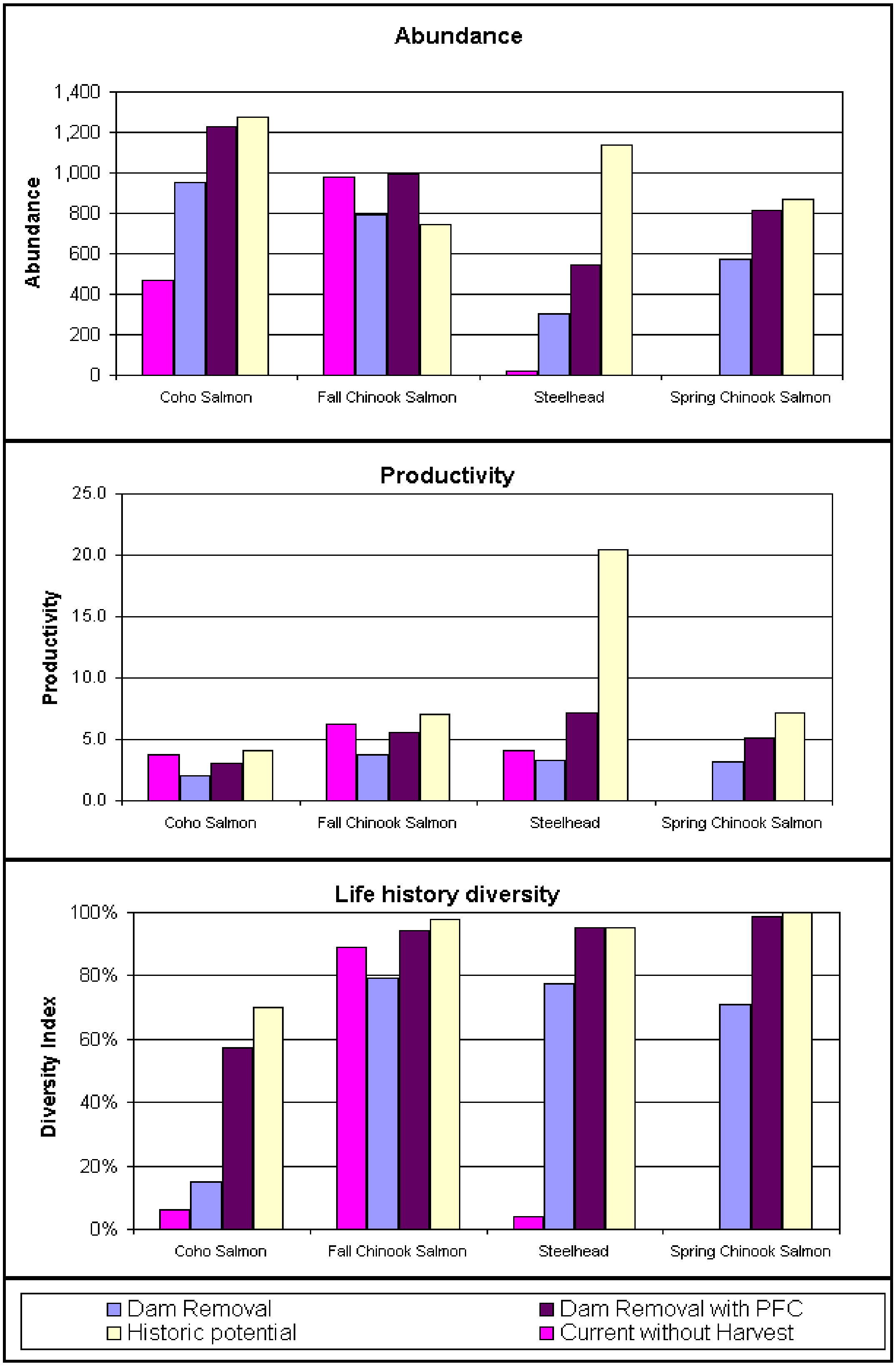


Figure 52 WDFW proposed future scenarios for the White Salmon River

To meet the long-term biological objectives, the EDT - level 2 environmental attributes identified in the key finding sections need to be modified. The primary habitat attributes that limiting anadomous fish and need to be addressed are: the presence of obstructions, the lack of wood, reduction in riparian function, higher maximum temperature, increased % fines in spawning gravel, increased peak flow, and reduced channel stability. The watershed processes that control these attributes are access, riparian, sediment, and hydrology (table 32). The access process is controlled by Condit Dam and is being addressed through the FERC relicensing. The riparian process is in good shape except for riparian function in Rattlesnake and Indian Creeks and lack of wood in all reaches due to reduced recruitment and removal. The sediment and hydrology processes are controlled by roads and forest clearing.

Table 32 Key linkages between watershed process and reach scale environmental attributes, which need to be improved to meet PFC biological objectives.

Watershed Process	Key Environmental Attributes
Access	Obstruction at Condit Dam
Riparian	Riparian Function, Wood, and Maximum Temperature
Sediment Transport	Percentage of Fines in Spawning Gravel
Hydrology	Peak Flows and Bed Scour

The most biggest challenges to efforts to return habitat to more normative conditions will be the sediment and hydrology due to higher road densities. Much of the upper assessment unit is under federal ownership and managed by the USFS and their watershed analysis recommendations include reducing road densities. The riparian function in the mainstem is good and can be improved with landowner co-operation in the tributaries. Wood recruitment will as protected riparian areas mature. However, there is a challenge in the mainstem White Salmon River striking a balance of leaving sufficient wood in the river for fish habitat and maintaining enough open channels for whitewater recreation.

6.1.4 Strategies

The proposed management strategies to meet biological objectives in the White Salmon subbasin are based on the management actions including protection, restoration, rehabilitation, substitution, and degradation from NRC (1996). Since subbasin goals are not presently being met, we propose all habitat efforts focus on protection, restoration, and rehabilitation. Substitution and degradation should be considered a last option and should be implemented only after a comprehensive analysis that incorporates public involvement. It should be noted that in this process, protection occurs through the implementation and enforcement of existing regulation and through “co-operative” processes involving incentives, public education and outreach, and other voluntary actions. This process does not include the development of new regulations.

Estimation of geographic specific restoration and preservation values is one of several EDT applications. This analysis is based on the same fish abundance, productivity, and diversity information derived for population analysis from historic/template and current/patient habitat conditions. Geographic area analysis provides a greater level of detail as it identifies areas based on their preservation value and restoration potential. It should be noted that areas that have a larger capacity (greater length and width) and areas lower in the mainstem, which have the most life history trajectories, are often ranked higher for both restoration and preservation. It should be noted the preservation/restoration scale changes from 60% to 140% depending on the species

Preservation value is estimated as the percent decrease in salmon performance if a reach was thoroughly degraded. Reaches with a high preservation value should be protected because of the disproportionately high negative impact on the population that would result from degradation. Restoration value is estimated as the percent increase in salmon performance if a reach is completely restored. A reach with a high restoration potential would provide a greater benefit to the population than a reach with low restoration potential.

Preservation and restoration are two sides of the same coin. Areas with excellent habitat conditions have high preservation values but low restoration values. Areas with poor habitat conditions have high restoration potential but little preservation value. Geographic areas analysis results are specific to each fish species because of the different fish habitat requirements of each. These analyses results are typically displayed in a graphical format that is often referred to as a ladder or tornado diagram.

The preservation/restoration analyses for this subbasin are presented in figures 54-57. The analysis for fall chinook salmon is the most straight forward and indicates the areas below Condit Dam has to be protected for this species. This makes sense because 96% of the spawning and rearing areas is below the dam. There is significant restoration opportunity in this reach for productivity.

For coho salmon this same reach is also a very high priority for protection. This is due to the fact that all trajectories pass through this reach and it has a higher percentage of pool habitat than the rest of the subbasin due to BON inundation and some very long pools in the bypass reach. The analysis suggests that other mainstem reaches, Spring Creek, and Buck Creek would benefit from protection. The habitat in this subbasin is in fair shape and restoration opportunities for abundance are relatively low but habitat quality (productivity) has moderate restoration opportunities in these same reaches.

For spring chinook salmon all mainstem reaches have preservation benefits, which are higher than the tributaries. Significant restoration opportunities exist in the mainstem above the Condit Dam.

Steelhead protection is needed in the mainstem and Rattlesnake Creek. The mainstem from the top of the reservoir to Husum Falls is the geographic area with the highest protection value. This is the most popular reach in the mainstem to fish for rainbow trout. Current sampling by USGS supports that Rattlesnake Creek is a good producer of rainbow trout. Therefore, it makes sense that steelhead would perform well in these geographic areas if rainbow trout are currently performing well. Rattlesnake Creek has the most significant restoration opportunity.

Figure 53 Preservation/restoration analyses of geographic areas for winter steelhead

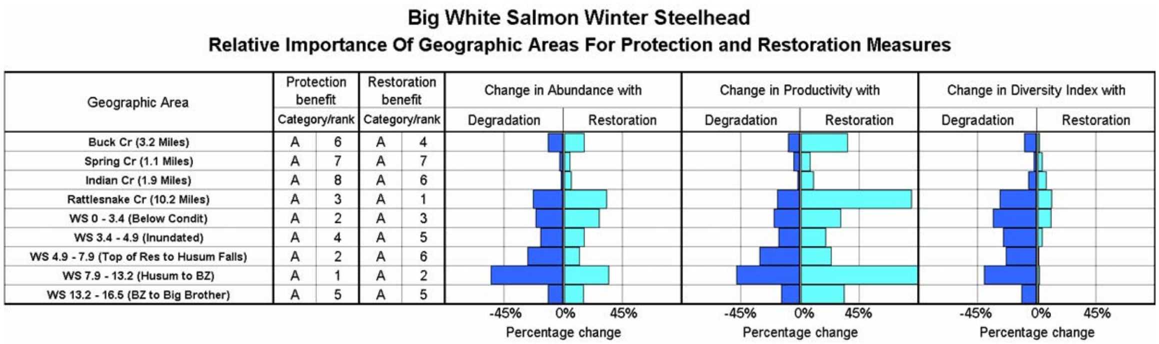


Figure 54 Preservation/restoration analyses of geographic areas for fall chinook

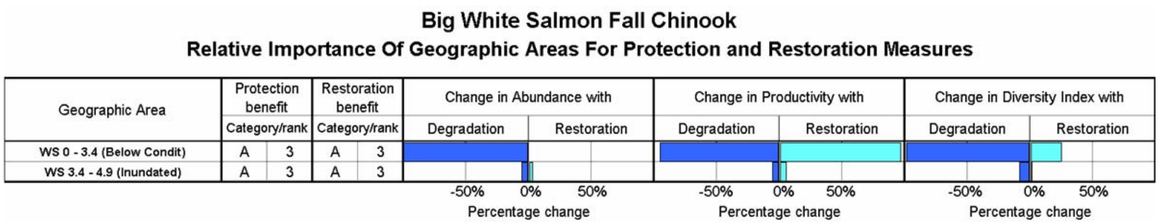


Figure 55 Preservation/restoration analyses of geographic areas for spring chinook

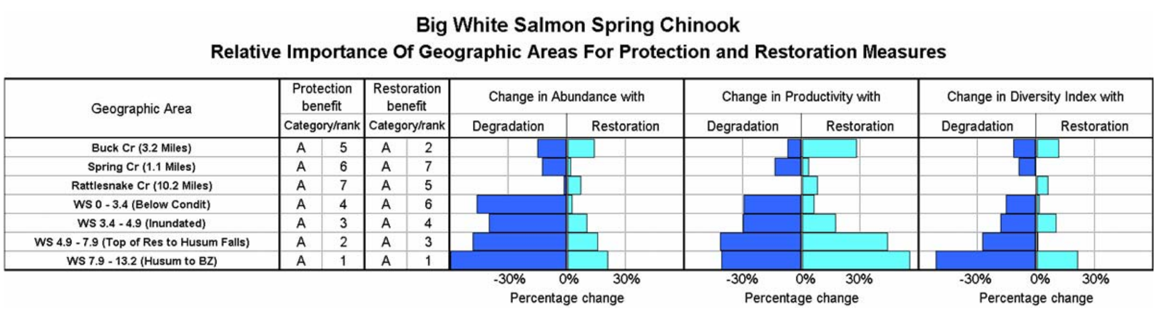
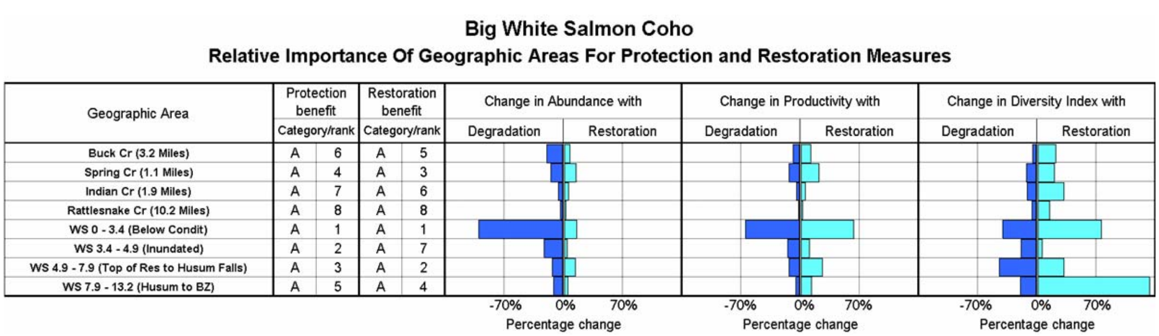


Figure 56 Preservation/restoration analyses of geographic areas for coho



Protection/Restoration analysis for coho salmon, steelhead, spring chinook, fall chinook.

Protection: The EDT model results suggest that many reaches in the White Salmon basin have quality habitat and functional ecological processes that are capable of supporting anadromous fish populations. Protection of functional ecosystem processes and intact habitats should have the highest priority. Protection can be attained by minimizing or avoiding human activities that seriously and adversely affect aquatic and riparian ecological functions. Protection of functional riparian areas and mainstem water temperature is a high priority. Examples of protection include portions of the State of Washington DNR "Forest and Fish Rules" (FFA) and parts of the President's Northwest Forest Plan (NFP). Each of these incorporate actions that protect and minimize the effect of land management on riparian habitats. Other examples of protection approaches may include riparian conservation easements and voluntary landowner protection of riparian areas attained through education and outreach conducted by the Underwood Conservation District.

Restoration: The EDT model results also suggest many reaches have moderate habitat quality and quantity, and have the potential to be improved to high quality habitat. In natural or passive restoration the sources of human caused disturbance are removed and natural process are allowed to restore the habitat. Alternately, active restoration combines the natural recovery with management activities to accelerate recovery. The USFS, UCD, and BPA funded riparian restoration projects in the Trout Creek flats and Wind River mining reach projects are examples of providing active riparian restoration. Given the current Forest and Fish Agreement and the Northwest Forest Plan, restoration of many riparian areas in forested lands are likely to occur through passive restoration. However, the FFA also provides for some riparian management that is intended to attain the targeted mature stand conditions in a shorter time through light thinning of understory trees in overstocked stands. This agreement also calls for development and implementation of road maintenance and abandonment plans, which may result in improvement of riparian stands, reconnecting streams to floodplains, and reduce sediment and peak flows. These latter actions described in the FFA would be considered active restoration. Other examples of active restoration include planting of riparian areas, actions to reduce effects of livestock on riparian areas, projects the improve channel morphology, and upgrading or removal of roads.

Rehabilitation

In this strategy, habitats and ecological functions are restored to the extent practical because it is acknowledged that irreversible changes have occurred in the subbasin and only partial restoration of habitats and ecological functions can be achieved. For example, state highways and county roads along the White Salmon River are not likely to be removed to minimize the hydro-confinement of the stream, but modifications to those roads, such as improvements of road drainage structures, could by completed to minimize their effects. This is the strategy explicitly recognizes that human impacts in the subbasin are and will continue to occur; and subbasin plans can only be successful if they develop realistic expectation.

Substitution

This strategy includes enhancement and mitigation. Enhancement is the deliberately increasing habitats and ecological functions, outside the range of natural conditions, to some higher level. Mitigation is an attempt to offset habitat losses by improving or creating habitats elsewhere and involves technological intervention. We recognize this strategy may be needed in this subbasin but it should be formally adopted as a strategy after a watershed assessment and habitat feasibility plan are completed. An example of an enhancement strategy would be to increase salmon carcass levels to above historical levels to jump start the anadromous re-introduction program. Another example is that we acknowledge in the out of basin assumptions, that hydro-electric operations have and will continue to occur and that substitution funds from continuing hydro-system losses should be allocated to this subbasin for protection, restoration, rehabilitation, and assessment.

Degradation

This strategy allows for the deterioration of ecological process and habitat loss due to human activities. This is not effective strategy to achieve the subbasin biological goals of restoring naturally producing anadromous salmonids to healthy and harvestable levels.

Restoration Opportunities

These following tables portray restoration opportunities. Moving from left to right in each table, are listed:

1. a strategy, which is a set of actions to accomplish the biological objectives or assessment which address a data gap/uncertainty in analysis or assumptions
2. the life stage affected by the strategy
3. the biological objective of the strategy
4. the level of certainty the effect is occurring and significant
5. the relationship between the watershed process, physical habitat and salmon performance
6. the recommended action
7. the reaches for the recommended action

The WDFW fishery analysis considered primary recommended actions to be those that address a significant limiting factor, have a high likelihood of achieving the biological objective, and can be proposed within the next five years. The secondary recommendations may address less limiting factors, be implemented after 5 years, and/or have less certainty in biological response. Similar standards were used for assessments. These represent these best opportunities for restoration and monitoring, it is likely that using EDT scenario builder would refine these opportunities further. However, there was not sufficient time in the process for this to be completed.

The wildlife matrixes were similarly constructed, though in the context of focal species in three focal habitat types. The intent of each matrix is to present actions and strategies which may be implemented to address the key findings and limiting factors. Furthermore, to the extent possible, appropriate geographical locations were identified for certain actions and strategies. The geographical locations were then designated as a primary or secondary tier action area.

A general theme across the subbasin is a reduction in the quantity and quality of all types of wildlife habitat that the focal and other species need to flourish.

Riparian wetlands have been lost as floodplain habitats have been converted to human uses. That loss of riparian wetland habitat structure and hydrology reduces or ecological function.

This plan's objectives and strategies recommend efforts to restore riparian wetland habitat in order to bring benefit to both fish and wildlife. Those actions involve both restoring habitat by increasing native vegetation and creating adequate hydrological conditions to reconnect habitats in tributary and mainstem floodplain areas.

Strategies to restore beaver habitat are possible and will bring populations closer to historic levels, helping to achieve the goal of restoring hydrological function to floodplains. The restored habitat would benefit beaver, whose activities would in turn benefit the salmon and steelhead that visit the watershed. Beaver dams result in the creation of off channel habitat and increased channel stability.

Shrub steppe habitat has been reduced in quanitity and quality. Land conversion and changes in fire intervals has resulted in fragmentation and reduction in size of functional shrub steppe habitat. Shrub steppe has been replaced by agriculture and grassland. Grassland quality has been reduced and in many places is mostly a monoculture of cheatgrass and other noxious weeds.

Habitat quality and ecological function in Ponderosa pine / Oregon white oak habitat has been reduced because of altered forest species composition and age structure. Historic harvest practices and fire suppression have resulted in a replacement of late seral stands and large overstory trees with smaller trees and denser stands.

Wildlife habitat objectives include retaining any surviving late seral stands and large decadent wildlife trees and managing stands to restore functional habitat. Such strategies include identifying areas where thinning and/or prescribed burning would help achieve habitat objectives and thinning appropriate stands to decrease stand density.

6.2 Fish Hypotheses, Objectives and Strategies

6.2.1 Strategies and Assessment opportunities to provide anadromous fish access above Condit Dam

Table 33 Strategies and Assessment opportunities to provide anadromous fish access above Condit Dam.

Strategy for access above Condit Dam Biological Processes (Reference)	Life Stages	Cause/ Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
Provide anadromous fish access to the area above Condit Dam.	All	The Condit Dam blocks access to habitat upstream of the dam. Steelhead, coho and spring chinook production would be significantly increased if passage were provided	Initiate actions to provide passage of anadromous salmon and steelhead above Condit Dam	Restoration opportunities require assumptions about passage at Condit Dam. Uncertainty about implementing actions will exist until Condit Dam passage decisions are finalized	High certainty that passage is blocked and that this blockage is the most limiting factor in the subbasin	High certainty that coho, spring chinook, and steelhead performance will increase if fish passage is provided to habitat upstream of Condit Dam.	Dam removal has the highest level of confidence in meeting biological objectives. There is less certainty with adult and juvenile passage.	Primary: WDFW and YN recommend that dam removal proceed on schedule if DOE grants a clean water certification . Klickitat County recommends an alternative fish passage or dam removal plan, which the County believes will have less adverse impact to existing salmonid habitat.	All

Strategy for access above Condit Dam Biological Processes (Reference)	Life Stages	Cause/ Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
Update draft re-introduction plan to reflect new information and subbasin priorities. Plan should include risk assessment, hypothesis testing for strategies, population and physical habitat M &E, and adaptive management sections.	All	Draft re-introduction plan was developed by Co-managers in the mid-1990's.	Since the original draft reintroduction plan was developed, salmon and steelhead have been listed under ESA. There is a need to incorporate new information including subbassin biological objectives into reintroduction plan.	After dam access is provided, re-introduction strategies will include re-colonization and/or re-introduction, which have different risks and time scales	High certainty that an updated plan with specific hypothesis testing is required to determine successful re-introduction strategies..	High certainty that plan will guide re-introduction strategies and M & E to evaluate these strategies.	High certainty that without an updated plan, little will be accomplished regarding re-establishment of populations.	**Primary:** Update re-introduction plan based on new information and subbasin goals.	All

Strategy for access above Condit Dam Biological Processes (Reference)	Life Stages	Cause/ Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
Maintain genetic diversity of unique populations below Condit Dam if removal strategies put species at risk.	All	The primary risk to population and genetic structure resulting from modification or removal of the dam is the expected short-term effects on existing habitat downstream of the dam. Spawning may be lost for one or more years sue to habitat degradation.	Develop population and genetic diversity maintenance program in the event the habitat below dam is not functional for some period of time.	This assumption is based on the proposed dam removal option in the Settlement Agreement. Other anadromous access options have different risks.	High certainty that if dam removal occurs as planned populations spawning below Condit Dam will have high incubation losses during their first year and possibly subsequent years. Incubation losses will be reduced as sediment if flushed and habitat stabilizes.	High certainty that increased sediment loads will decrease egg incubation survival.	WDFW has high certainty that the combination of protection strategies will be successful based on previous hatchery intervention and re-introduction efforts. Klickitat County's biologists dispute this conclusion.	**Primary:** **1) Protect** unique Tule Fall Chinook program by maintaining broodstock at USFWS Spring Cr. Hatchery. 2) **Protect** unique O. mykiss in above Condit Dam for possible steelhead re-colonization. **3) Assess** coho population structure to determine best options **Secondary:** **1) Protect** population structure and abundance of local salmon and steelhead population to serve as donor stocks. These include Klickitat, Hood, and Wind River River steelhead and chinook stocks.	All

Strategy for access above Condit Dam Biological Processes (Reference)	Life Stages	Cause/ Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
Develop and implement population monitoring and pit and CWT tagging programs to determine extent and survival of juvenile outmigration and harvest in fisheries. Develop data of sufficient high quality to support development of stock-recruit relationships (spawner to adult and spawner to smolt).	Ad ult an d Sm olt	1) Population monitoring is needed assess if biological goals are being met. 2) Assess EDT rearing assumptions in Columbia River. 3) Assess resident trout contribution to anadromy. 4) Assess species interactions between rainbow/steelhea d and tule/bright fall chinook. 5) Estimate out of basin harvest.	Develop and implement successful adult and juvenile monitoring program.	Without adequate funding for population monitoring and hypothesis testing prior to, during, and after dam removal or passage, a unique opportunity to test re-introduction strategies for anadromous salmonids will be missed.	High certainty that access to area above Condit Dam will occur.	High certainty that access with be followed with re-introduction of anadromous salmonids into upper watershed.	WDFW has high certainty that tule fall chinook, coho salmon, and steelhead populations will be effective at re-establishing self-sustaining populations but less certainty for spring chinook salmon. Klickitat County believes there is less certainty for fall Chinook rebuilding after proposed dam removal.	**Primary:** Adult and juvenile population monitoring is needed to meet adaptive management called for in subbasin[D1] and draft reintroduction plans.	**All**
Provide salmon carcasses.	Ju ve nile	Lack of salmon carcasses has decreased food and the survival of juvenile salmonids and wildlife	Increase salmon carcasses into reaches above Condit Dam	Nutrients are limiting production of fishes and wildlife in the basin	High certainty that no salmon carcasses are above Condit Dam since there is no adult fish passage.	High certainty that salmon carcasses benefit juvenile survival and wildlife.	Low certainty about reaching biological objectives due to lower limiting factor. However, initial substitution strategy of surplus	**Primary:** **1)Substitute** strategy currently has carcasses from hatchery strays meeting or exceeding historical levels below Condit Dam. **Secondary:** **1)Rehabilitate** strategy is	Belo w Cond it Dam All

Strategy for access above Condit Dam Biological Processes (Reference)	Life Stages	Cause/ Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
					However, salmon carcasses were never very abundant in this area and are a lower limiting factor.		hatchery or carcass analogs should be pursued.	needed because salmon harvest will occur. Salmon carcasses should be factored in harvest allocation. **2)Substitution** strategy uses disease free hatchery carcasses and/or carcass analogs for areas above Condit Dam. This strategy may be primary to jump start population.	All

6.2.2 Strategies for improving anadromous habitat above Condit Dam

Table 34 Strategies for improving anadromous habitat above Condit Dam

Strategy for improving habitat above Condit Dam (Reference)	Life Stages	Cause/Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
In the near term, focus on protection, restoration, and rehabilitation of habitat upstream of Northwestern Lake. Use adaptive management based on M & E program to develop strategies for the remainder of the basin	All	Until the particulars on the type of fish access and its timing , the effects on habitat are unknown. Thereofore, planning for habitat restoration and rehabilitation in the areas downstream of the dam should be postponed.	Protect, restore and rehabilitate habitat and watershed processes upstream of Northwestern Reservoir.	Habitat protection, restoration, and rehabilitation in basin should be focused on areas not likely to be impacted by Condit Dam due to mechanism uncertainty. Priority areas include tributaries and mainstem above Northwestern Reservoir.	High is certainty that access will be provided.	High certainty in biological response from addressing habitat issues identified in areas upstream of Northwestern Reservoir. See specific actions listed below for this area.	Confidence of meeting biological objectives is high in mainstem and tributaries above Northwestern Reservoir.	**Primary:** Only habitat actions above Buck Creek should be considered in the near-term. **Secondary:** Habitat actions below Reservoir should be delayed until certainty of Condit Dam is finalized. Implement projects in the effected area after Condit Dam operation is finalized.	All reaches above Northwestern Reservoir. All reaches below Northwestern Reservoir

Strategy for improving habitat above Condit Dam (Reference)	Life Stages	Cause/Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
Action: restore riparian zone through planting seedlings. (Reference)	Active and inactive Juvenile Active Juvenile Egg Spawner	1) Juvenile survival has decreased due to lack of habitat diversity which is directly affected by wood in streams. 2) Maximum stream temperatures in summer in excess of water quality standards decreases survival 3) Increase sediment during incubation reduces survival. 4) Spawning gravels in the basin are limited and LWD would help retain them	1) Increase recruitment of LWD to create pools and increase cover. 2) Plant riparian area to increase canopy cover which reduces stream temperatures. 3) Plant trees to reduce sediment inputs from unstable banks 4)) Increase recruitment of LWD to retain spawning gravel	Plantings yield to positive biological response. However, recovering riparian areas, which reduce stream temps, stabilize banks, and produce LWD recruitment is a long-term process.	High certainty that riparian function in Rattlesnake and Indian Creeks are impaired less so for other units.	High certainty that the juvenile survival is reduced in these creeks due to increased maximum temperatures and loss of wood.	High certainty that replanting will provide shade and lead to wood recruitment to the stream. However, recovery of riparian zones is a long-term process.	**Primary:** 1)**Assessment** as part of subbasin physical habitat of monitoring program, 2**) Protect** functional riparian zones in all reaches, 3) **Restore** plant riparian areas in Rattlesnake and Indian Cr to decrease temperatures and increase future wood recruitment. **Secondary:** Implement projects based on physical habitat monitoring program.	All with focus above Condit Dam All Rattlesnake and Indian Creeks All

Strategy for improving habitat above Condit Dam (Reference)	Life Stages	Cause/Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
Place wood in streams to restore habitat	Active and Inactive Juvenile Egg Spawner	1) Juvenile survival has decreased due to lack of habitat diversity (wood) which has led to downcutting due to lack of roughness components in stream. 2) Increase sediment during incubation reduces survival. 3) Spawning gravels in the basin are limited and LWD would help retain them 4) Some reaches are	1) increase volume of pool habitat to enhance juvenile survival 2) provide roughness in stream segments that are downcutting to stop erosion of bed and protect unstable banks 2) provide wood to capture and sort sediments, increasing the availability of spawning gravels	Engineered LWD placement will yield a positive biological response. However, adding wood is only a short-term solution unless wood recruitment for riparian and upslope areas is addressed (see prior strategy for planting riparian areas).	High certainty that wood is lacking in entire subbasin.	High certainty that the juvenile survival is reduced due to loss of wood.	High certainty that LWD placement will be effective in creeks but unsure about effectiveness in mainstem due to very confined reaches which tend to transport wood and removal of wood by rafters.	Primary: 1)**Assessment** as part of subbasin physical habitat of monitoring program, 2**<u>) Protect</u>** wood in streams and functional riparian zones in all reaches. Secondary: 1) **<u>Restore</u>** wood in Spring, Rattlesnake and Indian Cr by placement after anadromous passage is established 2)Implement based on physical habitat monitoring and after public input with boaters in mainstem.	**All** **All Buck, Spring,Rattle Snake, and Indian Creeks** **All**
Modify or remove roads	Egg and	Egg incubation survival is	Increase channel stability and	An assessment is	High certainty that	Moderate certainty that	High certainty that removal of	Primary:	

Strategy for improving habitat above Condit Dam (Reference)	Life Stages	Cause/Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
and dikes encroaching on stream beds and floodplains	Inactive Juvenile	reduced due to channel instability caused from confinement in localized areas. This channel instability reduces over wintering survival during the inactive life stage as well.	reduce peak flows by reducing confinement. After removal of road or dike, should proceed to riparian restoration.	needed to identify areas of priority action. Note, some of the confining roads are state highways and other major roads. These projects will be expensive. This is a less significant limiting factor in this assessment unit.	road /dike hydro-confinement s are present at isolated locations in the basin.	removal will increase channel stability and reduce peak flows leading to increased alevin and egg survivals because the effect of confinement on scour and channel stability is not as well known.. Certainty will increase once assessment is complete	hydro-confinement is effective but specific areas where treatment is beneficial need to be assessed	1) **<u>Protect</u>** streams from road encroachment. **Secondary:** 1)**<u>Assessment</u>** is needed with a focus on potentially isolated reaches in Rattlesnake and Indian Cr. 2)**<u>Rehabilitate</u>** by eliminating or reducing channel confinement to the extent practical in identified reaches.	All Rattlesnake and Indian Creeks Rattlesnake and Indian Creeks
Reduce sediment inputs an reduce increases in peak flows originating from roads	Egg and inactive juveniles	Overwintering and egg incubation survival is limiting due to channel instability due to increase peak flows and sedimentation.	Reduce sediment inputs from roads. Hydrologically disconnect road system from streams.	Literature makes strong links between roads and flow/sediment. Roads should be evaluated to identify those that are contributing the highest	High certainty that roads are increasing peak flows and sediment but lower certainty of site specific roads	High certainty between the effect and response.	High certainty that reduction in roads or implementation of BMPs will be effective but again site specific effects are less certain	Primary: 1)**<u>Protect</u>** key suibbasin from increased road, 2) **<u>Assessment</u>** of road system to identify those that are the highest contributors of sediment and	All Lower and upper assessment units excluding FR and federal

Strategy for improving habitat above Condit Dam (Reference)	Life Stages	Cause/Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
				levels of sediment and flow.	effects.			flow 2) **Rehabilitate** roads to the extent practical based on USFS Watershed Analysis and roads assessment.	lands Upper Assessment Unit
Actions for reduction in pre-spawning morality is impacted by recreational use	Adult	Heavy recreational whitewater use may increase harassment of adult salmonids above Condit Dam	Ensure pre-spawning salmon and steelhead mortalities are minimized	Uncertainty in the link between harassment and pre-spawning losses. This is a low limiting factor.	Low certainty that recreational activity is a significant source of mortality	Low certainty in the between boat use and prespawning mortality.	Low certainty that a proposal to limit boater use would be public supported.	**Primary:** See primary wood strategy. **Secondary:** **1)Assessment** of boater use and if research indicates impacts is significant	All White Salmon
Support watershed planning and watershed plan implementation (Reference)	Juvenile	Water withdrawals in summer limit habitat capacity and may lead to increase temperatures below diversions. Lack of	Eliminate fish access through intakes. Increase stream flow to increase habitat and help reduce summer temperatures		High certainty irrigation diversion in Buck Cr. divert up to 70% of the flow.	High certainty that water withdrawals reduce summer rearing capacity and unscreened systems impinge	High certainty screening project will be effective but should include operations and maintenance funds. Lower certainty regarding effect of	**Primary**: **Assessment** of instream flows and screening of water intakes through the Klickitat County - WRIA 29 planning effort to develop actions for water	All but focus on Buck, Indian, Spring, and Rattlesnake Creeks, which are a high priority

Strategy for improving habitat above Condit Dam (Reference)	Life Stages	Cause/Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
		screening on intakes can result in stranding of fish in canals				salmonids.	increased flows on biological objectives. This would be increased with an assessment.	resource management. This effort will include establishment, protection, and rehabilitation of instream flows.	
Reduce run off from dairies and failed septic systems	Juvenile	Fecal coliform levels have increased and nutrient enrichment may decrease juvenile or adult survival	Decrease fecal coliform levels		High certainty that this effect is occurring but not believed to be a significant limiting factor.	Low certainty about the relationship between fecal coliform and juvenile or adult salmon survival.	Low certainty that this will provide significant salmon performance benefits	Secondary **Rehabilitate** strategy to reduce fecal coliform levels to DOE standards	All but current problems in upper assessment unit
Increase the percentage of the forest in the watershed that is managed for hydrologically mature conditions		Deforestation especially in rain-on-snow elevations has led to increased peak run off, which has increased bed scour and reduced juvenile survival	Decrease routing of sediment and peak flows into streams.		High certainty that this is occurring.	Medium certainty on the relationship between immature forest and peak flows.	Medium certainty that coordinated timber harvest schedule would reduce peak flow	Primary: **Rehabilitate** strategy to have USFS, DNR, and other forestry managers to coordinate timber harvest rotation to maximize hydrologic mature conditions.	Upper assessment unit
CULVERTS									

Strategy for improving habitat above Condit Dam (Reference)	Life Stages	Cause/Working Hypothesis (Reference)	Biological Objective (Reduce/Eliminate Negative Causes, or Improve/maintain positive causes)	Key Assumptions	Confidence effect is actually occurring and significant	Confidence in relationship between effect and biological response	Confidence project will meet biological objectives	Recommended Actions	Recom-mended Reaches
(need to be added)									
Conduct study to assess the degree of competition between natural bright and tule chinook populations	Juvenile and adult	Species interactions occur between a the native tule and introduced upriver bright fall chinook salmon	Decrease potential competition between tules and upriver brights	Introduced upriver bright fall chinook salmon have become established in the White Salmon River	High certainty this is occurring. It is unclear if this is a significant limiting factor	Moderate certainty the extent of super-imposition	Low certainty that this affect could be changed given the US v OR agreements	**Primary:** See population monitoring program in the Condit Dam Access Section.	Below Condit Dam

6.3 Wildlife Biological Objectives and Strategies

6.3.1 Interior Riparian Wetlands Habitat

Biological Objectives and Strategies and Tier Rankings by Geographical Areas

Table 35 Interior Riparian Wetlands biological objectives and strategies and tier rankings by geographical areas

TIER DEFINITIONS:	**Project or Actions:**	**Primary-- Able to be implemented within next 5 years and addresses significant limiting factors; high likelihood of achieving biological objective.**		
		Secondary-- Not able to be implemented in next 5 years and/or less certainty of achieving biological objective.		
CODES:	**O = Objective**	**FO = Field Observation**		**R = Research Literature**
	S = Strategy	**B = Best Professional Judgment**		**I = Information Needed**
	F = From Fish Data	**L = Local Residential Information**		**H = Habitat Database**
Target Objectives and Strategies	**Associated Limiting Factor**	**Tier Rankings by Geographical Areas**		**Source**
		Primary	**Secondary**	
O: Restore ecologically functional floodplain / riparian wetland habitats. S: Inventory roads near riparian habitat and assess impacts to determine problem areas in need of resolution. S: As appropriate, relocate, remove, or repair roads that are causing loss of hydrological function.	Reduction in Floodplain Acreage	Lower Rattlesnake Creek		

O: Restore riparian habitat quality by increasing native vegetation in degraded riparian habitat. S: Continue and enhance riparian weed control programs.	Displacement of Native Riparian Vegetation with Non-native Vegetation			
O: Slow stream flow, restore water table, repair stream banks, restore riparian vegetation and reconnect floodplain. S: Use lease, easement or purchase practices to protect functioning floodplain areas and streams. S: Reintroduce beavers, plant native vegetation and reintroduce large woody debris.	Incised Stream Reaches	Rattlesnake Creek Upper Rattlesnake Creek – Panakanic Meadows		
O: Restore historical beaver populations. S: Reintroduce beaver into areas that have suitable habitat. S: Restore areas to prepare for beaver reintroduction.	Loss of Hydrological Function	Primarily upper basin		
O: Increase source of large woody debris (LWD), in the form of large trees and snags, in riparian buffers. S: Promote silviculture practices that retain large woody debris within riparian buffers. S: When adequate amounts of large trees or snags are not present, place large woody debris into streams.	Loss of Stream Complexity and Increased Flows	Various locations throughout subbasin. Placement of LWD: Various locations in tributaries and headwaters.		

O: Restore and protect remaining riparian buffers from conversion. S: Utilize easements, leases or agreements for landowners to restore or protect riparian vegetation (e.g. Farm Program partner, etc.).	Loss of Riparian Habitat and Function Fragmentation of Habitat	Upper Rattlesnake Creek – Panakanic Meadows		
O: Restore native riparian tree and shrub habitats degraded by inappropriate grazing. S: Provide incentives through easements, leases or agreements for landowners to manage livestock in such a way to provide for riparian vegetation restoration (eg. Farm Programs).	Overall Loss of Riparian Vegetation	Lower Rattlesnake Creek, Indian Creek Upper Rattlesnake Creek – Panakanic Meadows		

6.3.2 Interior Riparian Wetlands Focal Species (Yellow Warbler and Western Pond Turtle)

6.3.3 Biological Objectives and Strategies and Tier Rankings by Geographical Areas

Table 36 Yellow Warbler biological objectives and strategies and tier rankings by geographical areas

TIER DEFINITIONS:	**Project or Actions:**	**Primary-- Able to be implemented within next 5 years and addresses significant limiting factors; high likelihood of achieving biological objective.**		
		Secondary-- Not able to be implemented in next 5 years and/or less certainty of achieving biological objective.		
CODES:	**O = Objective**	**FO = Field Observation**	**R = Research Literature**	
	S = Strategy	**B = Best Professional Judgment**	**I = Information Needed**	
	F = From Fish Data	**L = Local Residential Information**	**H = Habitat Database**	
Target Objectives and Strategies	**Associated Limiting Factor**	**Tier Rankings by Geographical Areas**		**Source**
		Primary	**Secondary**	
O: Increase quality and quantity of habitat for yellow warblers. O: Restore yellow warbler population numbers to historic levels. S: Inventory existing and potential yellow warbler habitat. S: Create / retain optimal habitat (see assessment).	Reduction in Floodplain Acreage Overall Habitat Loss Fragmentation of Habitat	Fund landowner incentive projects that provide riparian habitat In Trout Lake Valley and tributaries.		

O: Reduce mortality of food base (insects), needed by yellow warblers, from chemical applications. S: Use alternative control measures for undesirable species in riparian buffers, especially in areas used by yellow warbler.	Reduced Food Base			

Table 37 Western pond turtle biological objectives and strategies and tier rankings by geographical areas

TIER DEFINITIONS:	***Project or Actions:***	**Primary-- Able to be implemented within next 5 years and addresses significant limiting factors; high likelihood of achieving biological objective.**	
		Secondary-- Not able to be implemented in next 5 years and/or less certainty of achieving biological objective.	
CODES:	**O = Objective**	**FO = Field Observation**	**R = Research Literature**
	S = Strategy	**B = Best Professional Judgment**	**I = Information Needed**
	F = From Fish Data	**L = Local Residential Information**	**H = Habitat Database**

Target Objectives and Strategies	**Associated Limiting Factor**	**Tier Rankings by Geographical Areas**		**Source**
		Primary	**Secondary**	
O: Increase quantity of habitat for western pond turtles. S: Utilize purchase easements, leases or agreements, for landowners to restore or protect riparian vegetation (e.g. Farm Program partner, etc.)	Reduction in Floodplain Acreage Fragmentation of Habitat	Along Columbia River drainage areas between the mouth of Big White Salmon and Klickitat Rivers.		

O: Increase quality of habitat for western pond turtles. S: Create optimal habitat (see assessment). S: Inventory roads near occupied or potential western pond turtle habitat and assess impacts to determine problem areas in need of resolution. S: Augment or support shoreline and adjacent uplands weed control programs. S: Promote silviculture practices that retain buffer of shoreline trees (basking log recruitments) within western pond turtle habitat. S: Provide incentives through easements, leases or agreements, for landowners to manage livestock in such a way to provide for riparian vegetation restoration (e.g., farm programs).	Loss of Riparian Habitat and Function Displacement of Native Riparian Vegetation with Non-native Vegetation Overall Loss of Riparian Vegetation	Along Columbia River drainage areas between the mouth of Big White Salmon and Klickitat Rivers. Improve specific habitat features at WDFW managed Klickitat Wildlife Area for WPT.		
O: Eliminate predation from non-native species. S: Remove bullfrog and non-native fish from occupied sites and control current bullfrog and non-native fish occupation in potential habitat.	Predation by Non-Native Animal Species	Along Columbia River drainage areas between the mouth of Big White Salmon and Klickitat Rivers. Improve specific habitat features at WDFW managed Klickitat Wildlife Area for WPT.		
O: Decrease disturbance to western pond turtles. S: Restrict access to known western pond turtle sites.	Increase in Human Disturbance	Along Columbia River drainage areas between the mouth of Big White Salmon and Klickitat Rivers.		

6.3.4 Ponderosa Pine / Oregon White Oak Habitat

6.3.5 Biological Objectives and Strategies and Tier Rankings by Geographical Areas

Table 38 Ponderosa Pine / Oregon White Oak Habitat biological objectives and strategies and tier rankings by geographical areas

TIER DEFINITIONS:	**Project or Actions:**	**Primary-- Able to be implemented within next 5 years and addresses significant limiting factors; high likelihood of achieving biological objective.**		
		Secondary-- Not able to be implemented in next 5 years and/or less certainty of achieving biological objective.		
CODES:	**O = Objective**	**FO = Field Observation**	**R = Research Literature**	
	S = Strategy	**B = Best Professional Judgment**	**I = Information Needed**	
	F = From Fish Data	**L = Local Residential Information**	**H = Habitat Database**	

Target Objectives and Strategies	**Associated Limiting Factor**	**Tier Rankings by Geographical Areas**		**Source**
		Primary	**Secondary**	
O: Increase average dbh and decrease understory density. S: Encourage silviculture practices that retain large diameter trees and reduce understory density.	Reduction of Large Diameter Trees and Snags	Lower White Salmon Rattlesnake Cr Indian Creek Spring Creek Catherine and Majors	Burdoin Mt.	
O: Retain late seral stands and large decadent trees. S: Create / implement guidelines to retain specified number of large diameter, decadent live trees.	Reduction of Large Diameter Trees and Snags	Lower White Salmon Rattlesnake Cr Indian Creek Spring Creek Catherine and Majors	Burdoin Mt.	

O: Decrease stand density of ponderosa pine. O: Decrease stem density of ponderosa pine. S: Reduce fuel loads through forestry practices. S: Reintroduce low intensity, controlled, site-specific fires. S: Manage grazing and forest practices that mimic fire, when necessary.	Increased Stand Density and Decreased Average Tree Diameter in Ponderosa Pine Stands	Lower White Salmon Rattlesnake Cr Indian Creek Spring Creek Catherine and Majors	Burdoin Mt.	
O: Decrease / reverse displacement of Oregon white oak by Douglas-fir and ponderosa pine in historically oak dominated stands. S: Utilize silviculture practices that reduce conifer dominance in historically oak dominated stands. S: Reintroduce low intensity, controlled, site-specific fires.	Displacement of Oregon White Oak by Conifer Encroachment	Lower White Salmon Rattlesnake Cr Indian Creek Spring Creek Catherine and Majors	Burdoin Mt.	
O: Retain existing tracts of late seral forests and reduce future fragmentation. S: Augment and support conservation oriented programs on small private land holdings. S: Use lease, easement or purchase practices to conserve remaining intact pine / oak forests.	Loss of Large Tracts of Old Growth, or Late Seral, Forests	Lower White Salmon Rattlesnake Cr Indian Creek	Burdoin Mt.	

O: Reduce non-native species presence and reestablish native plant communities. S: Continue and enhance noxious weed control programs. S: Where appropriate, utilize site-specific grazing management plans to achieve habitat improvement.	Loss of Native Understory Vegetation and Composition	Lower White Salmon Rattlesnake Cr Indian Creek Spring Creek Catherine and Majors	Burdoin Mt.	

6.3.6 Ponderosa Pine/Oregon White Oak

(Focal Species: Western Gray Squirrel and Lewis' Woodpecker)

Table 39 Western gray squirrel biological objectives and strategies and tier rankings by geographical areas

TIER DEFINITIONS:	**Project or Actions:**	**Primary-- Able to be implemented within next 5 years and addresses significant limiting factors; high likelihood of achieving biological objective.**		
		Secondary-- Not able to be implemented in next 5 years and/or less certainty of achieving biological objective.		
CODES:	**O = Objective**	**FO = Field Observation**		**R = Research Literature**
	S = Strategy	**B = Best Professional Judgment**		**I = Information Needed**
	F = From Fish Data	**L = Local Residential Information**		**H = Habitat Database**
Target Objectives and Strategies	**Associated Limiting Factor**	**Tier Rankings by Geographical Areas**		**Source**
		Primary	**Secondary**	
O: Increase quantity of western gray squirrel habitat. S: Increase compliance with forest guidelines for western gray squirrels.	Loss of Large Tracts of Old Growth, or Late Seral Forests	Lower White Salmon Lower Rattlesnake Creek Oak Ridge Road Indian Creek	Catherine and Majors Creek	

S: Retain remaining large, unfragmented tracts of western gray squirrel habitat.		Jewett Creek	Burdoin Mt.	
O: Increase quality of western gray squirrel habitat. S: Use site-specific fire prescriptions to enhance potential and used western gray squirrel habitat. S: Create / retain optimal habitat (see assessment).	Increased Stand Density and Decreased Average Tree Diameter Reduction of Large Diameter Trees and Snags Loss of Native Understory Vegetation and Composition	Catherine and Majors Creek Jewett Creek	Catherine and Majors Creek Burdoin Mt.	
O: Retain decadent and other important wildlife trees. S: Encourage woodcutting to be used as a tool for thinning overstocked areas. S: Create public education programs.	Loss of Individual, Late Seral Trees (From Woodcutting)	Lower White Salmon Basin Jewett Creek	Catherine and Majors Creek Burdoin Mt.	
O: Reduce pressure to western gray squirrels from California ground squirrels and eastern gray squirrels. S: Create programs to control non-native wildlife and other non-historical species. S: Create public education programs.	Increased Competition to Western Gray Squirrels	Lower White Salmon Basin Jewett Creek	Catherine and Majors Creek Burdoin Mt.	

Table 40 Lewis' Woodpecker biological objectives and strategies and tier rankings by geographical areas

TIER DEFINITIONS:	**Project or Actions:**	**Primary-- Able to be implemented within next 5 years and addresses significant limiting factors; high likelihood of achieving biological objective.**		
		Secondary-- Not able to be implemented in next 5 years and/or less certainty of achieving biological objective.		
CODES:	**O = Objective**	**FO = Field Observation**	**R = Research Literature**	
	S = Strategy	**B = Best Professional Judgment**	**I = Information Needed**	
	F = From Fish Data	**L = Local Residential Information**	**H = Habitat Database**	
Target Objectives and Strategies	**Associated Limiting Factor**	**Tier Rankings by Geographical Areas**		**Source**
		Primary	**Secondary**	
O: Increase quantity of Lewis' woodpecker habitat. S: Encourage landowner incentives through compensation and land easements. S: Retain reserves and identify and protect important habitats.	Loss of Large Tracts of Old Growth, or Late Seral Forests	Catherine and Majors Creek Jewett Creek	Rattlesnake and Indian Creeks Catherine and Majors Creek Burdoin Mt.	
O: Increase quality of Lewis' woodpecker habitat. S: Increase number of snags and snag recruitment in Lewis' woodpecker habitat (review assessment for guidelines on optimal number of large diameter snags). S: Create site-specific fire prescriptions to enhance potential and used Lewis' habitat.	Reduction of Large Diameter Trees and Snags	Catherine and Majors Creek Jewett Creek	Rattlesnake and Indian Creeks Burdoin Mt.	

6.3.7 Montane Coniferous Wetlands Habitat

Biological Objectives and Strategies and Tier Rankings by Geographical Areas

Table 41 Montane Coniferous Wetlands Habitat biological objectives and strategies and tier rankings by geographical areas

TIER DEFINITIONS:	**Project or Actions:**	**Primary-- Able to be implemented within next 5 years and addresses significant limiting factors; high likelihood of achieving biological objective.**	
		Secondary-- Not able to be implemented in next 5 years and/or less certainty of achieving biological objective.	
CODES:	**O = Objective**	**FO = Field Observation**	**R = Research Literature**
	S = Strategy	**B = Best Professional Judgment**	**I = Information Needed**
	F = From Fish Data	**L = Local Residential Information**	**H = Habitat Database**

Target Objectives and Strategies	**Associated Limiting Factor**	**Tier Rankings by Geographical Areas**		**Source**
		Primary	**Secondary**	
O: Remove encroaching conifers from meadows. O: Decrease density of brush within wetland meadows. S: Where appropriate, prescribe low intensity burns for vegetation stimulation and biomass reduction.	Tree and Shrub Encroachment into Wet Meadows	Trout Lake Natural Area	Panakanic Meadows	
O: Restore stream channel planform and roughness, restore water table, repair stream banks, restore riparian vegetation and reconnect floodplain.	Incised Streams and Loss of Wetland Function	White Creek and Tepee Creek (Cedar Valley) Upper Klickitat (Cow Camp, Caldwell, Prairie, Kesler, McCormick Meadows – diffuse knapweed)		I,FO

S: Reintroduce beavers. S: Plant native vegetation. S: Reintroduce large woody debris.		Diamond Fork (Klickitat Meadows)		
O: Restore historical beaver populations. S: Reintroduce beaver into areas that have suitable habitat. S: Restore areas to prepare for beaver reintroduction.	Loss of Hydrological Function			I, FO
O: Restore native riparian tree and shrub habitats necessary for fish and wildlife habitat on the degraded river and tributary areas. S: Provide incentives through easements, leases or agreements, for landowners to manage livestock in such a way to provide for riparian vegetation restoration. S: Increase habitat quality by treating non-native species.	Displacement of Native Plant Communities by Non-native Plant Species	Trout Lake Natural Area	Panakanic Meadows	
O: Reduce damage to wetland vegetation from excessive grazing, and water quality due to inappropriate management of livestock grazing. S: Fence out grazers from sensitive meadows. S: Provide incentives through easements, leases or agreements, for landowners to manage livestock in such a way to provide for riparian vegetation restoration.	Overall Loss of Native Vegetation and Wetland Function	Panakanic Meadows		

O: Reduce damage to wetland hydrology from road presence. S: As appropriate, relocate, remove, or repair roads that are causing loss of hydrological function. S: Avoid future road building activities in sensitive wetland habitats.	Hydrological Alteration	Trout Lake Creek		
O: Reduce damage to wetland habitat from timber activities. S: Implement current guidelines to retain buffers around important wetlands and meadows. S: Use timber harvesting to remove encroaching conifers from meadows.	Upland Hydrological Effects	Trout Lake Creek		

6.3.8 Montane Coniferous Wetlands

(Focal Species: Oregon Spotted Frog and American Beaver)

Table 42 Oregon spotted frog biological objectives and strategies and tier rankings by geographical areas

TIER DEFINITIONS:	Project or Actions:	Primary-- Able to be implemented within next 5 years and addresses significant limiting factors; high likelihood of achieving biological objective.	
		Secondary-- Not able to be implemented in next 5 years and/or less certainty of achieving biological objective.	
CODES:	O = Objective	FO = Field Observation	R = Research Literature
	S = Strategy	B = Best Professional Judgment	I = Information Needed
	F = From Fish Data	L = Local Residential Information	H = Habitat Database
Target Objectives and Strategies	Associated Limiting Factor	Tier Rankings by Geographical Areas	Source

		Primary	Secondary	
O: Increase quantity of habitat for Oregon spotted frogs. S: Retain current suitable habitat. S: Where appropriate, restore habitat to suitable conditions. S: Purchase, lease, or easement practices to protect remaining important wetlands.	Loss of Wetlands	Trout Lake Natural Area Preserve		
O: Increase quality of Oregon spotted frog habitat. S: Remove encroaching conifers from meadows. S: Where appropriate, prescribe low intensity burns for vegetation stimulation and biomass reduction. S: Fence out grazers from sensitive meadows. S: Manage grazing around sensitive seasonal breeding (March-May) to protect frog egg masses. S: Provide incentives through easements, leases or agreements, for landowners to manage livestock in such a way to provide for riparian vegetation restoration.	Tree and Shrub Encroachment into Wet Meadows Decrease in Water Quality Displacement of Native Plant Communities by Non-Native Plant Species	Trout Lake Natural Area Preserve		
O: Eliminate bullfrogs from further invasion of montane wetlands and control current invasions.	Competition and Predation by Non-Native Species			

S: Implement control measures for bullfrogs and other identified species.				
O: Reduce risk of mortality of Oregon spotted frogs by various chemical applications. S: Use alternate control measures for undesirable species in wetlands.	Reduced Viability	Trout Lake Natural Area and Creek		

Table 43 American beaver biological objectives and strategies and tier rankings by geographical areas

TIER DEFINITIONS:	Project or Actions:	Primary-- Able to be implemented within next 5 years and addresses significant limiting factors; high likelihood of achieving biological objective.		
		Secondary-- Not able to be implemented in next 5 years and/or less certainty of achieving biological objective.		
CODES:	O = Objective	FO = Field Observation		R = Research Literature
	S = Strategy	B = Best Professional Judgment		I = Information Needed
	F = From Fish Data	L = Local Residential Information		H = Habitat Database
Target Objectives and Strategies	Associated Limiting Factor	Tier Rankings by Geographical Areas		Source
		Primary	Secondary	
O: Provide suitable habitat for beaver where they were historically found. S: Create optimal habitat (see assessment).	Overall Loss of Riparian Vegetation	Basin Wide		

O: Restore beaver populations to historical levels. S: Inventory existing and potential beaver habitat. S: Reintroduce beaver where / when appropriate.	Fragmentation of Habitat	Basin Wide		

7 Monitoring, Evaluation and Adaptive Management

Monitoring and evaluation efforts in this subbasin have been minimal to date. The following guidelines extracted from the Washington State Salmon Recovery Funding Board will be used when preparing project proposals in the future unless project proponents have a specific reason for changing the monitoring and evaluation criteria.

The Monitoring and Evaluation Strategy For Habitat Restoration documents published by the Washington Salmon Recovery Funding Board (SRFB) can be found at http://www.iac.wa.gov/srfb.

The following project types are addressed by this subbasin monitoring and evaluation plan:

- Fish passage projects
- Instream structure projects
- Riparian vegetation restoration projects
- Livestock exclusion projects
- Constrained channel projects
- Channel connectivity projects
- Spawning gravel projects
- Habitat protection projects at the parcel scale

7.1 Fish Passage Projects

The objective for fish passage projects is to increase access to areas blocked by human-cause impediments.

Types of Fish Passage Projects

Bridge projects, culvert improvements, small dam removals, debris removals, diversion dam passage, fishway construction, weirs, and water management projects.

Monitoring Goal

Determine whether fish passage projects are effective in restoring upstream passage to targeted fish species.

Questions to be answered:

Have the engineered fish passage projects continued to meet design criteria post-project for at least five years?

Have fish passage projects as an aggregate demonstrated increased abundance of target species post-project within five years?

Objectives

Before Project Objectives (year 0)

Project managers determine the proper design criteria for meeting the fish passage objectives for the project. Determine fish abundance both in the downstream control reach and impact reach upstream of the fish blockage for the sampled projects.

After Project Objectives (Years 1, 2, and 5)

Determine whether fish passage design criteria are being met at each project monitored. Determine salmon abundance both in the downstream control reach and impact reach upstream of the fish blockage for each project.

Response Indicators

- Design criteria: Project design criteria taken from construction blueprints or pre-project plan.
- Abundance: Salmon abundance can be determined using both adult spawner and redd counts and juvenile counts. Adult estimating procedures are found in SRFB Protocol 9. Juvenile estimating procedures are found in SRFB Protocols 7 and 8. The least intrusive monitoring protocol should be used whenever possible. Impact areas will be compared to the controls and to controls and impacts on other streams as well. The metrics used will be numbers per square meter for juveniles and number per kilometer or redds per kilometer for adults depending upon the target species.

7.1.1 Instream Structure Projects

Types Of Instream Structure Projects

Channel reconfiguration, installed deflectors, log and rock control weirs, roughened channels, and woody debris.

The objective for instream projects is to increase instream cover, spawning, and resting areas by constructing artificial instream structures. The basic assumption is creating more diverse pools, riffles, and hiding cover will result in an increase in local fish abundance.

Monitoring Goal

Determine if projects that place artificial instream structures (AIS) into streams are effective in improving stream morphology and increasing local fish abundance in the treated area at the stream reach level.

Questions to be answered:

1. Have AIS as designed remained in the stream for up to ten years for the sampled instream structure projects?
2. Has stream morphology improved significantly in the treated stream reach for the sampled instream structure projects within ten years?
3. Has salmon abundance increased significantly in the impact area for the sampled instream structure projects within ten years?

Objectives

Before Project Objectives (Year 0)

Determine the Thalweg profile in the impact and control areas for each of the instream structure projects sampled. Determine the numbers of adult and juveniles of the targeted salmon species in the control and impact areas for each of the instream structure projects sampled.

After Project Objectives (Years 1, 3, 5, and 10)

Determine the number and location of AIS within the treated area for the sampled instream structure projects. Determine the Thalweg Profile in the control and impact areas for the sampled instream structure projects. Determine the numbers of adult and juvenile of the target salmon species within the control and impact areas for the sampled instream structure projects.

Response indicators

- Number of AIS remaining in sampled reach: AIS must be identified using GPS coordinates and other techniques such as tags affixed to LWD in order to track the life of AIS over time. AIS sampling methods are found in Protocol 13 (SRFB 2003).
- Thalweg profile: The Thalweg profile characterizes pool-riffle relationships, sediment deposits, wetted width substrate characteristics, and channel unit-pool forming categories. Stream morphology sampling methods are taken from EMAP (Peck et al. unpubl.), Section 7.4. Protocols summarizing EMAP Table 7-3 and 7-4 are found in Protocols 14, 15, and 16. Sampling is based upon establishing 11 regular transects within each identified stream reach. Pre-project measures of the variation of depth throughout the stream reach and the residual pool volume will be compared to detect post-project changes.
- Abundance numbers of adult and juvenile salmon in the reach: Salmon abundance can be determined using both adult counts, redd counts, and juvenile counts. Adult estimating procedures are found in Protocol 9. Juvenile estimating procedures are found in Protocols 7 and 8. The least intrusive monitoring protocol should be used whenever possible. Impact areas will be compared to the controls and to controls and impacts on other streams as well. The metrics used will be numbers per square meter for juveniles and number per mile or redds per mile for adults depending upon the target species.

7.1.2 Riparian Vegetation Restoration Projects

The goal of riparian planting projects is to restore natural streamside vegetation to the stream bank and riparian corridor. The assumption is that riparian vegetation increases shading of the stream, leading to cooler temperatures more desirable for salmon rearing. Vegetative cover also reduces sedimentation and erosion, which can impact egg survival, food organisms, and the ability of salmon to find food.

Monitoring Goal

Determine whether riparian plantings are effective in restoring riparian vegetation, stream bank stability, and reducing sedimentation.

Questions to be answered:

1. Have at least 50% of the riparian plantings survived for at least 10 years?

2. Have the riparian shading and riparian vegetative structure been improved by year 10?

3. Has erosion and stream sedimentation been significantly reduced by year 10?

Objectives

Before Project Objectives (Year 0)

Determine the proportion of the three layers of riparian vegetation present within the project impact and control areas. Determine the proportion of shading within the project impact and control areas. Determine the proportion of actively eroding stream banks within the project impact and control areas.

After Project (Years 1, 3, 5, And 10)

Determine the overall survival of the species of riparian vegetation planted. Determine the proportion of the three layers of riparian vegetation present within the project impact and control areas. Determine the proportion of shading within the project impact and control areas. Determine the proportion of actively eroding stream banks within the project impact and control areas.

Response Indicators

- Number of trees and shrubs planted: The number of trees and shrubs planted at the time of the project. The Level 1 indicator tracks how many plantings actually survived over time as a measure of project effectiveness.

- Riparian vegetation: Using EMAP protocols (Peck et al. unpubl.), the percent shading is calculated using a densitometer and the riparian species diversity understory ground cover and canopy can be determined in a consistent manner. One would expect the percent shading and the species diversity to change over time as the plantings grow. The proportion of actively eroding streambanks is an indicator of sedimentation and erosion into the stream. If riparian plantings are effective in creating riparian cover, then bank erosion should decline.

7.1.3 Livestock Exclusion Projects

The goal of livestock exclusion fencing is to exclude cattle from the riparian area of the stream where they can cause severe damage to the stream by breaking down stream banks and increasing erosion, destroying shade producing trees and shrubs, and increasing sedimentation. By excluding cattle with fencing, these adverse impacts can be avoided and restoration of the shoreline can occur.

Monitoring Goal

Determine whether livestock exclusion projects are effective in excluding livestock, restoring riparian vegetation and restoring stream bank stability.

Questions to be answered:

1. Are livestock excluded from the riparian area?

2. Has riparian vegetation been restored in the impact area?

3. Has bank erosion been reduced in the impact area?

Objectives

Before Project Objectives (Year 0)

Determine overall use by livestock of the riparian area to be excluded. Determine the total acreage to be fenced. Determine the total kilometers of stream protected. Determine the overall riparian vegetation cover layers and percent shading within the project area.

Determine the overall proportion of stream bank actively eroding.

Post-Project Objectives (Years 1, 3, 5, and 10)

Determine the overall use by livestock of the riparian area excluded. Determine the overall riparian vegetation cover layers and percent shading within the project area.

Determine the overall proportion of stream bank actively eroding.

Response Indicators

- Exclusion effectiveness: Using Protocol 10, the presence or absence of livestock inside the exclusion can be used as a measure of the effectiveness of the fencing design in excluding livestock from the riparian area.
- Riparian indicators: Using EMAP protocols (Peck et al. Unpubl.), the percent shading (using a densiometer) is a metric that can be determined in a consistent manner. This metric was chosen because it has been shown to have one of the highest signal to noise ratios (17) of 18 different parameters measured involving riparian vegetation. Using EMAP protocols, the percent of riparian area containing all three layers of vegetation, canopy layer (.5m high), understory (0.5 to 5m high), and ground cover (0.5m high). This metric was chosen because it has been shown to have one of the highest signal to noise ratios (8) of 18 different parameters measured involving riparian vegetation. Using methods outlined in Protocol #17, the proportion of actively eroding streambanks can be determined within the sampled stream reaches.

7.1.4 Constrained Channel Projects

The goal of constrained channel projects is to restore the natural flood flow basin width so that gravel, large wood, and normal stream morphology and fish habitat can be restored. Diking, road construction, fills, and other construction work within the stream's normal flood line can constrain flow within the normal flow channel leading to scouring effects upon stream gravel, loss of hiding cover and food organisms, and unsuitable habitat for rearing juvenile salmon. Unconstrained streams dissipate flood flow energy over a broader valley floor and provide slower velocities for preserving stream channel morphology and rearing habitat for salmon.

Types of Constrained Channel Projects

Dike removal or setback, riprap removal, road removal or setback, and landfill removal.

Monitoring Goal

Determine whether projects that remove or set back dikes, riprap, roads, or landfills are effective in restoring stream morphology and eliminating channel constraints in the treated area.

Questions to be answered:

1. Has removal and/or setback reduced channel constraints and increased flood flow capacity for ten years?

2. Has stream morphology improved over ten years?

Objectives

Before Project Objectives (Year 0)

Determine the overall channel capacity and constraints in the impact area. Determine the overall stream morphology using Thalweg Profile in the impact area.

After Project Objectives (Years 1, 3, 5, and 10)

Determine the overall changes in channel constraints and flow capacity in the impact area. Determine the overall stream morphology using Thalweg Profile in the impact area.

Response Indicators

- Channel capacity: Channel capacity as cross-sectional area calculated from mean bankfull width (XBF_W) and height (XBF_H) measures the overall channel flow capacity. When a channel is constrained the velocity of the water increases to compensate for higher volume. Increased velocity scours stream bottom eliminating pools, large wood, and other structures associated with fish habitat.

- Thalweg profile: The Thalweg profile characterizes pool-riffle relationships, sediment deposits, wetted width substrate characteristics, and channel unit-pool forming categories. Stream morphology sampling methods are taken from EMAP (Peck et al. unpubl.), Section 7.4. Protocols summarizing EMAP Table 7-3 and 7-4 are found in Protocols 15, and 16 (SRFB, 2003). Sampling is based upon establishing 11 regular transects within each identified stream reach. Pre-project measures of the variation of depth throughout the stream reach (RP100) and the residual pool volume (AREASUM) will be compared to detect post-project changes.

7.1.5 Channel Connectivity Projects

Channel connectivity projects and off-channel habitat projects are designed to reconnect flood flow channels, oxbows, and other winter flood flow channels and winter rearing areas for fish and other aquatic organisms. Loss of channel connectivity is most often caused by manmade disturbances such as dikes, roads, fills, etc.

Types of Channel Connectivity Projects

Channel connectivity, off-channel habitat, and wetlands

The goal of channel connectivity projects is to restore lost channels and side channel rearing areas to active fish production and to dissipate the destructive effects of flood flows upon habitat.

Monitoring Goal

Determine whether projects that restore connectivity to channels that have previously been disconnected from the stream are effective in improving stream morphology and increasing fish abundance in the impacted area. This would include side channels, meander bends, old oxbows, and wetlands.

Questions to be answered:

1. Has the reconnected channel remained attached to the stream as designed?

2. Has off-channel stream morphology improved over time?

3. Has riparian vegetation in the off-channel impact area changed from upland to wetland species?

4. Has salmon abundance increased in the off-channel impact area over time?

Objectives

Before Project Objectives (Year 0)

Determine the overall size and configuration of the disconnected channel in the impact and control areas. Determine the plant community characteristics in the impact and control areas. Determine the overall stream morphology using Thalweg Profile in the impact and control areas. Determine the overall abundance of targeted fish species in the impact and control areas.

After Project Objectives (Years 1, 2, and 5)

Determine the effectiveness of the connected channel within the impacted area. Determine the plant community characteristics within the impact and control areas. Determine the overall stream morphology using Thalweg Profile in the impact and control areas. Determine the abundance of target fish species within the control and impact areas.

Response Indicators

- Connected channel. The channel connection must remain functional as designed for the project to be considered a success. The response indicator in this case is whether the channel has remained connected to the main channel of the stream thereby meeting design criteria.

- Thalweg profile. The Thalweg profile characterizes pool-riffle relationships, sediment deposits, wetted width substrate characteristics, and channel unit-pool forming categories. Stream morphology sampling methods are taken from EMAP (Peck et al. Unpubl.), Section 7.4. Protocols summarizing EMAP Table 7-3 and 7-4 are found in Protocols 14, 15, and 16 (SRFB, 2003). Sampling is based upon establishing 11 regular transects within each identified stream reach. Pre-project measures of the variation of depth throughout the stream reach and the residual pool volume will be compared to detect post-project changes.

- Riparian species diversity and percent shading: Using EMAP protocols, the percent shading (using a densiometer) and riparian species diversity are metrics that can be determined in a consistent manner. One would expect the percent shading and the species diversity to change over time after the channel has been reconnected.

- Abundance: Salmon abundance can be determined using both adult counts and juvenile counts. Adult estimating procedures are found in Protocol 9. Juvenile estimating procedures are found in Protocols 7 and 8. The least intrusive monitoring protocol should be used whenever possible. Impact areas will be compared to the controls and to controls and impacts on other streams as well. The metrics used will be numbers per square meter for juveniles and number per mile or redds per mile for adults depending upon the target species.

7.1.6 Spawning Gravel Projects

Spawning salmon require clean gravel of the proper size in order to spawn successfully. Where the stream is subjected to high sediment loading, gravel that is normally the proper size and location may become embedded into a matrix of silt and clay sediments that do not provide aeration of the redd.

The goal of gravel placement projects is to improve spawning capabilities within the impacted area by artificially placing gravel in the stream. The assumption is that spawning areas are a limiting factor in producing juvenile salmon, and placing gravel in the stream should result in an increase in successful spawning and local juvenile and adult fish abundance.

Monitoring Goal

Determine if projects that place spawning gravel into streams are effective in improving salmon spawning, and increasing local adult fish abundance in the impacted area at the stream reach level.

Questions to be answered:

1. Has gravel placed in the stream remained in the stream for up to ten years for the sampled gravel replacement projects?

2. Has gravel remained usable for spawning over time or has it become embedded with fines?

3. Have more adult salmon utilized the new spawning gravel?

Objectives

Before Project Objectives (Year 0)

Determine the total area of spawning gravel in the impact and control areas for each of the gravel placement projects sampled. Determine how embedded the spawning gravel is in the control and impact areas for the sampled gravel placement projects. Determine the percentage of fines in the gravel in the control and impact areas for the sampled gravel placement projects. Determine the numbers of adult spawners of the targeted salmon species in the control and impact areas for each of the gravel placement projects sampled.

After Project Objectives (Years 1, 3, 5, and 10)

Determine the total area of spawning gravel in the impact areas for each of the gravel placement projects sampled. Determine how embedded the spawning gravel is in the control and impact areas for the sampled gravel placement projects. Determine the percentage of fines in the gravel in the control and impact areas for the sampled gravel placement projects. Determine the numbers of adult spawners of the targeted salmon species in the control and impact areas for each of the gravel placement projects sampled.

Response Indicators

- Area of gravel remaining in the sampled reach: Spawning gravel placed in the stream must be identified using GPS coordinates and other techniques such as streambank markers in order to track the life of the gravel placement over time.
- Gravel characteristics. Gravel characteristics can be quantified using the EMAP protocol for characterizing stream substrate (Peck et al. Unpubl.). This protocol measures size of substrate. Percent of fines is commonly used as a measure of siltation. Embeddedness is also determined (see Protocol 12, SRFB, 2003).
- Abundance: Salmon abundance can be determined using adult spawner counts. Adult estimating procedures are found in Protocol 9. The least intrusive monitoring protocol will be used whenever possible.

7.2 Habitat Protection Projects at the Parcel Scale

A protection project is a property acquired either in fee title or a property protected by a restrictive use agreement or easement for the purpose of:

1. Protecting identified blocks of critical habitat that protect fish and wildlife from further population declines.

2. Protection of property providing key linkages connecting fragmented habitats.

3. Protection of property used to enhance habitat and to offset poor habitat elsewhere in the watershed.

Determine whether habitat protection parcels as a whole and individually are effective in maintaining or improving fish and wildlife habitat and invertebrate species assemblages within the parcel boundaries.

Monitoring Goal

Determine whether habitat protection parcels as a whole and individually are effective in maintaining and/or, improving fish and wildlife and invertebrate species assemblages within the parcel boundaries.

Questions to be answered:

1. Have the protected properties maintained or improved the riparian habitat benefits for which they were purchased?

2. Have the protected properties maintained or improved the upland habitat benefits for which they were purchased?

3. Has the biological condition of the macro-invertebrate and fish and wildlife assemblages improved, declined or stayed the same within the protected properties?

Objectives

Baseline (Year 0)

Determine status of instream, riparian and upland habitat within each randomly selected parcel. Determine the biological condition of macro-invertebrate and fish and wildlife species assemblages using a multi-metric index for each randomly selected parcel.

Post-Acquisition Objectives (Years 3, 6, 9, and 12)

Determine trends in instream, riparian and upland habitat within each randomly selected parcel compared to the baseline year. Determine status of macro-invertebrate and fish and wildlife species assemblages using a multi-metric index for each randomly selected parcel.

Response Indicators

- Thalweg profile. The Thalweg profile characterizes pool-riffle relationships, sediment deposits, wetted width substrate characteristics, and channel unit-pool forming categories. Stream morphology sampling methods are taken from EMAP (Peck et al. unpubl), Section 7.4.
- Riparian plants: Riparian condition is determined by measuring the plant density and species composition within the study reach. It is also important to measure stream bank erosion. Streamside riparian habitat sampling methods are taken from EMAP (Peck et al. Unpubl.), Section 7.4.
- Upland plants: Upland plant community sampling methods are taken from the National Park Service “Fire Monitoring Handbook (FMH)”, Chapter 4 Monitoring Program Design, Table 3, Table 4 and Figures 9-14; and Chapter 5 Vegetation Monitoring Protocols Tables 5-10 and Figures 15-20. SFRB Protocols summarizing FMH protocols are found in Protocol X (SRFB, 2003).
- Macro-invertebrate assemblages: Stream macro-invertebrate species composition and relative abundance of particular groups show strong correlations with water quality and watershed health factors. Changes in macro-invertebrates would indicate that water quality conditions within the parcel have changed over time. Macro-invertebrate sampling methods are taken from EMAP (Peck et al. unpubl), Section 11. Protocols summarizing EMAP Table 11-2, 11-3, and 11-4 are found in Protocols X (SRFB, 2003) and in the Department of Ecology’s “Benthic Macro-Invertebrate Biological Monitoring Protocols for Rivers and Streams”, Publ No. 01-03-028. Indicators considered most sensitive to regional change are compared using a multi-metric index (Karr and Chu, 1999; Wiseman, 2003).

Abundance: Salmon abundance can be determined using both adult counts and juvenile counts. Adult estimating procedures are found in Protocol 9. Juvenile estimating procedures are found in Protocols 7 and 8. The least intrusive monitoring protocol should be used whenever possible. Impact areas will be compared to the controls and to controls and impacts on other streams as well. The metrics used will be numbers per square meter for juveniles and number per mile or redds per mile for adults depending upon the target species.